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YOUNG LEADERS FOR HEALTH

SOCIAL ENTREPRENEURSHIP CHALLENGE ON EHEALTH

NON COMMUNICABLE DISEASES & AIR QUALITY

JUNE 13-16, 2019
BERLIN, GERMANY

CONTENT GUIDE

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YOUNG LEADERS FOR HEALTH

Programme of the Young Leaders for Health

Social Entrepreneurship Challenge on eHealth on Non-Communicable Diseases and Air Quality

Time	Thursday June 13th	Friday June 14th	Saturday June 15th	Sunday June 16th
9:00 - 9:30		Keynote Speech II	Keynote Speech III	Deadline for projects
9:30 - 10:00		Keynote Speech II	Keynote Speech III	Breakfast
10:00 - 10:30				Breakfast
10:30 - 11:00		Workshop II	Teamwork	Project Pitches
11:00 - 11:30		Workshop II	Teamwork	Project Pitches
11:30 - 12:00				Project Pitches
12:00 - 12:30		Lunch	Lunch	Project Pitches
12:30 - 13:00		Lunch	Lunch	Project Pitches
13:00 - 13:30	Registration	Tips from the jury	Words of Wisdom	Jury Reconvenes
13:30 - 14:00	Registration	Tips from the jury	Teams continue working with their mentors	Jury Reconvenes
14:00 - 14:30	Introduction	Workshop III	Teams continue working with their mentors	Award Ceremony
14:30 - 15:00	Keynote Speech I	Workshop III	Teams continue working with their mentors	Award Ceremony
15:00 - 15:30	Keynote Speech I	Workshop III	Teams continue working with their mentors	Award Ceremony
15:30 - 16:00	Break	Workshop III	Teams continue working with their mentors	Award Ceremony
16:00 - 16:30	Teambuilding	Teams start working with their mentors	Teams may work without their mentors (venue is open until midnight)	Award Ceremony
16:30 - 17:00	Workshop I	Teams start working with their mentors	Teams may work without their mentors (venue is open until midnight)	Award Ceremony
17:00 - 17:30	Workshop I	Teams start working with their mentors	Teams may work without their mentors (venue is open until midnight)	Award Ceremony
17:30 - 18:00	Workshop I	Teams may work without their mentors (venue is open until midnight)	Teams may work without their mentors (venue is open until midnight)	Award Ceremony
18:00 - 18:30	Social Event (until 22:00)	Teams may work without their mentors (venue is open until midnight)	Teams may work without their mentors (venue is open until midnight)	Award Ceremony
18:30 - 19:30	Social Event (until 22:00)	Teams may work without their mentors (venue is open until midnight)	Teams may work without their mentors (venue is open until midnight)	Award Ceremony

Dear Participant,

The Organising Committee of the YLH Social Entrepreneurship Challenge on eHealth 2019 is excited to welcome you in Berlin on June 13 th for its 3rd edition on Non-communicable diseases and Air Quality.
Our event aims to provide an interdisciplinary platform for students and young professionals from all over the world to realize their ideas in the field of eHealth. During the course of 4 days, you will meet your team that will be as passionate and enthusiastic about modern advancements in health as you; you will be inspired by experts in their field through keynote lectures; and you will learn valuable skills from workshop instructors and mentors that will guide you through the YLH Social Entrepreneurship Challenge on eHealth.

We have selected Non-communicable diseases and Air Quality as this year's theme because we at Young Leaders for Health believe that it is a topic of global relevance. Air pollution is an issue that probably affects your community and has been ignored for too long.
Seeing that many relevant solutions tackling pollution have come from within their respective communities, we encourage you to work on an aspect of the theme that you personally deem relevant. Your goal at the YLH Social Entrepreneurship Challenge on eHealth should be to create a project that your whole team is passionate about and that you all want to continue working on after the Challenge.

To support you in your work, we have created this Content Guide. It includes curated information on this year's theme and will also serve you as a guide when visiting Berlin. The information on Air Quality, NCDs, and eHealth is intended to give you an overview of the topic and encourage further reading. It is by no means a complete collection of the information available on that topic and should be accompanied by delving into the references we have provided.

After months of preparation, we look forward to meeting all the participants, keynote speakers, mentors and jury members. Moreover, we are excited to see what innovative project ideas each team will develop over the course of this weekend in Berlin. We appreciate everyone joining our collective effort in order to make way for crucial progress in the global health arena.

Yours,
the Organising Committee, YLH Social Entrepreneurship Challenge on eHealth 2019

Partners 2019

Code of Conduct

Young Leaders for Health strives for our Social Entrepreneurship Challenge to be a welcoming, safe and inclusive environment for all participants.

We therefore have a zero tolerance policy towards any form of harassment from or towards our participants. Harassment includes but is not limited to offensive verbal or written comments related to gender, age, sexual orientation, disability, physical appearance, body size, race, religion, social class, economic status, veteran status, sexual images, deliberate intimidation, stalking, following, harassing photography or recording, sustained disruption of talks or other events, inappropriate physical contact, and unwelcome sexual attention.

Sexual language and imagery is not appropriate at any point in the challenge, including in products developed, presentations, talks, demonstrations or in related social media content.

If what you're doing is making someone feel uncomfortable, that counts as harassment and is enough reason to stop doing it. Participants asked to stop any harassing behavior are expected to comply immediately.

If a participant engages in harassing behavior, YLH may take any action it deems appropriate, including warning the offender or expulsion from the event with no eligibility for reimbursement or refund of any type.

If you are being harassed, notice that someone else is being harassed, or have any other concerns, please contact a member of the organising committee. All issues raised will be treated with respect, and the organising committee will take every action to assist those experiencing harassment to feel safe for the duration of the event.

We expect participants to follow these rules at all challenge venues, online interactions in relation to the event, and challenge related social events. Sponsors, judges, mentors, volunteers, organizers, YLH staff, and anyone else at the event are also subject to the anti-harassment policy.

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eHealth

There is no universally accepted definition of 'eHealth', an abbreviation of electronic health. The World Health Organization (WHO) definition details it as "devices, drugs, medical, and surgical procedures - and the knowledge associated with these - used in the prevention, diagnosis and treatment of disease as well as in rehabilitation, and the organizational and supportive systems within which care is provided".[1] This spectrum ranges from mobile health technology (mHealth), to hospital information technology, to artificial intelligence and robotics. An explanation of each of these domains of eHealth is given in Table 1 below.

The ways in which technology is used in direct patient care varies greatly. It has advanced diagnostics by allowing analysis of patient's genomes, point of care testing (i.e. immediate test results at a patient's bedside) and the use of artificial intelligence to assess medical images.[2] Patients are also availing of improved disease management, such as by tracking real time biometric or symptom data, or through promoting better medicines adherence.[3] E- health can also improve health equity by facilitating access to health information and services, such as allowing patients to consult with medical professionals from their own homes.

Increasingly, countries are capitalising on technology to not only provide better care to patients, but also to improve health system efficiency.[4] Technology is being applied to hospital logistics, such as improving patient flow and tracking use of medicines, allowing more effective use of time and resources. The public health system is using technology to promote healthy lifestyles and behaviours, with the aim to prevent illness through incentivising behaviour change.[5] In the long term this aims to reduce the disease burden on health systems, as well as improve population health and wellbeing.

Technology has also been used to support global incidents such as pandemics, providing innovative ways to identify, monitor and respond to hazards.[6] This is just one example of the improved access to health system data, such as electronic health records, that technology brings, as well as innovative ways to analyse large and complex datasets. Use of such data science by health systems is growing, providing a deeper understanding of how illness occurs, how our health systems function and how we can best influence these.

Global eHealth also incorporates a broad category of technology that while not directly health interventions, address the wider determinants of health, through reducing malnutrition, improving sanitation, and increasing safety on roads.

This difficulty defining eHealth can impact its adoption, with patients, clinicians and health system leaders alike struggling to know how to assess the available technology. Although there is growing evidence of eHealth effectiveness, this is an evolving and complex area to develop research in. Any technology to be used in health should be carefully and robustly evaluated, and it's research base interrogated - especially if intended to replace current best standard of clinical practice. This may require innovative approaches to how we determine effectiveness, using new research methods or metrics, as well as new interpretations of evidence.

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Assessment of sociotechnical aspects of an eHealth intervention should also beperformed, so as to understand how technology is integrating into workflows, or how workflows are influenced by technology.

The potential of eHealth to address growing health system concerns and health care needs is often identified in the literature, but clear evidence of its value remains uncertain. Taking into account the cost effectiveness of a technology alongside its clinical or social impact is important when reviewing eHealth alongside other system priorities. It should also be considered whether an intervention is increasing health or socioeconomic inequalities, or presenting a risk to data privacy or security.

Table 1. Domains of eHealth

Domain of eHealth	Definition
mHealth	Mobile Health, or mHealth, concers the use of mobile devices for accessing health information or services, or tracking personal biometrics. This can include smartphone applications, video conferencing and wearable devices.
Telemedicine	The use of technology for remote diagnosis and management of patients, such as through video conferencing.
ICT	Information and communications technology is the internet, wireless networks and hardware (such as phones or computers required to use an eHealth technology).
Data Science	The use of scientific methods, processes, algorithms and systems to extract knowledge and insights from structured and unstructured data.
Artificial Intelligence	The development of computer systems able to perform tasks normally requiring human intelligence, such as voice recognition, visual perception and decision making.
Robotics	The design, construction, operation, and application of robots.

Principles of eHealth development

The vast variations in what constitutes eHealth means it can be difficult to set mandatory standards for its creation - affecting quality assurance, safety and implementation. It has been estimated that 80% of technology projects fail[6] due to uncertainty, abandonment and lack of organisational willingness to adopt[7] . By adhering to a number of principles of good practice developers of health technology ensure their creations are not only effective, but that patients and health professionals are able to trust and engage with them.

Key principles which should be considered:[8]

Evidence based: any technology should be rigorously tested in the setting it is intended to be deployed within. The level of evidence of effectiveness required before a tool is integrated into a health system will depend on the outcomes it is required to measure and whether it is designed to complement or replace current gold standard of care.

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User focused: those for whom the technology is being created for should be included in their planning, design and evaluation. Tools must be aligned with the specific health system and health needs of the entity (institution, subnational region, country) and culture involved.

This will also ensure acceptability with users, thus driving effectiveness. A range of stakeholders, such as patients and healthcare professionals, may need to be involved in an iterative process.

Compliance with standards: national and international protocols for health technology regulatory standards should be understood and adhered to. This includes user data protection, error reporting and robust models of consent.

Information governance: gathering and storing of information about users should be done as per the information governance and data protection legislation of the country the tool is operating in e.g. GDPR compliant for European operations.

Information accessibility: data should be defined consistently throughout, and the definitions should be understandable and available to all users and systems.

Implementable: based on strategy, health priorities and available infrastructure. Whether training will be required for operability should be considered, as should the need for individual/ organisational technical support.

Cost efficiency: the planning stages of technology development should consider how much it could cost for people/organisations to implement and whether it will save money or resources in the future.

Diversity: developers of eHealth tools should ensure there is diversity in the data they use to create their technology, as well as in the developers used to make them, to minimise bias and ensure applicability to a wide population.

Success of eHealth interventions will also rely on them being part of a wider digital health strategy. Not only will this provide a long term focus for a country or region's use of eHealth, but will allow for better evaluation of these tools and ensure appropriate infrastructure is in place.[9]

Design thinking

Design Thinking is a solution-based approach to solving complex problems. It calls for an empathetic approach by demanding developers thoroughly understand the users of a technological tool and the core needs it should address. This requires an iterative process, using brainstorming sessions for ideas generation and adopting a hands-on approach in prototyping and testing. eHealth services often have multiple stakeholders, from patients to healthcare professionals, who have a range of needs and expectations. These users are uniquely placed to identify problems with a technology system or service and facilitate suggestions for improvement.

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Where possible, developers should involve a diversity of potential users that reflects the intended population for their technology.

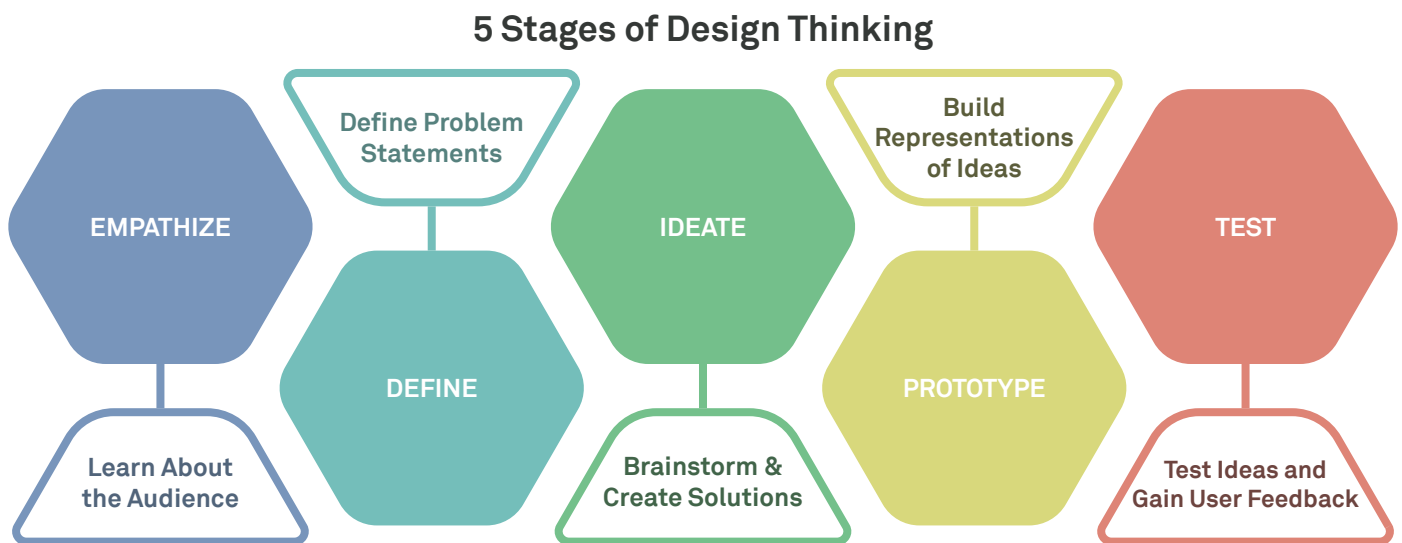The details of each stage of the design thinking process are shown in **Figure 1.**

5 Stages of Design Thinking

Figure 1 - Stages of Design Thinking

> **Empathise:** observing, engaging and empathizing with people to understand their experiences and motivations, as well as immersing yourself in the physical environment where possible so you can gain a deeper personal understanding of the issues involved.

> **Define:** analyse your observations and synthesise them in order to define the core problems that you and your team have identified up to this point. You should seek to define the problem as a problem statement in a human-centred manner.

> **Ideate:** start to ''think outside the box'' to identify new solutions to the problem statement you've created, and you can start to look for alternative ways of viewing the problem. Get as many ideas or problem solutions as possible at the beginning of the Ideation phase. You should pick some other Ideation techniques by the end of the Ideation phase to help you investigate and test your ideas so you can find the best way to either solve a problem or provide the elements required to circumvent it.

> **Prototype:** produce a number of inexpensive, scaled down versions of the product or specific features found within the product, so they can investigate the problem solutions generated in the previous stage. The aim is to identify the best possible solution for each of the problems identified. The solutions are implemented within the prototypes, and they are investigated and either accepted, improved and re-examined, or rejected on the basis of the users' experiences. By the end of this stage, the team will have a better idea of the constraints inherent to the product and the problems that are present, and have a clearer view of how real users would behave, think, and feel when interacting with the end product.

> **Test:** rigorously test the complete product using the best solutions identified during the prototyping phase. during this phase, alterations and refinements are made in order to rule out problem solutions and derive as deep an understanding of the product and its users as possible.

eHealth on a global scale

Adoption of eHealth has been varied both within and between countries, with concern that technology is perpetuating, rather than addressing, inequalities.
Disproportionately less resources have been dedicated to the development of technology to meet the needs of the world's poorest people. Technologies from high-income countries are often deployed in low income settings without thorough evaluation as to effectiveness or acceptability, and as such might rapidly become useless or even cause harm. Even when appropriate technology does exist, it is frequently inaccessible, due to cost or because of constraints related to resources or distribution.[10] Yet there is a huge drive to engage with eHealth low and middle-income countries, who could soon overtake high-income countries in its use - as these have been slow to move away from existing systems and processes.

Health technologies intended to be used in resource poor settings should be adequately evidenced within the context they are to be deployed in, using relevant local intelligence to assess clinical and cost effectiveness. Careful consideration should also be given to achievement of successful implementation and scale-up, requiring a focus not only on technology but also on associated procedural innovations that enable effective implementation.[10]

The WHO Global Initiative on Health Technologies aims to help make available the benefits of health technologies, particularly to communities in resource-limited settings, in order to effectively control important health problems.[11] It aims to challenge the international community to establish a framework for the development of National Health Technology Programmes that will impact the burden of disease and ensure effective use of resources.
The WHO also runs a joint initiative with the International Telecommunication Unit (ITU) to support governments in utilising eHealth for improving disease prevention, called Be He@lthy Be Mobile. Instead of promoting specific products, it provides cross-cutting health content and technical support which can be used and incorporated into other applications, increasing scalability.[12]

Accountability and regulation in eHealth

The difficulty defining eHealth brings grey areas of what counts as 'health' technology, and thus should be regulated as such. There is also concern that the assumptions used to determine whether technology is regulated as a medical device may not reflect how the technology is actually used. Populations are understandably confused as to which sources of information and advice they can trust, with a proliferation of applications and interventions that are not clinically validated.

International agreements on the governance of health technology exist, but these are largely informal and non binding. Many countries or regions have codes of conduct which should, or in some cases must, be adhered to. Such governance is important for ensuring quality of the tool, information provided etc. as well as safeguarding user safety and ensuring products are fit for purpose.

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Ways of addressing these challenges have been proposed, such as increasing transparency through openly publishing documentation; adding situated methods to usability standards to account for everyday use of personal health technology, and allowing patient groups to review mobile phone apps, draft their own guidelines, and collaborate with each other and with app developers.[13]

Barriers to using eHealth

Despite a growing focus on utilising eHealth, numerous barriers to its development and implementation still exist.[14,15] These can arise at an individual or systemic level, and may be financial, legal, ethical or social in nature.

Barriers to instituting effecting and sustainable eHealth technologies which have been commonly identified include:

Infrastructure: there is a lack of infrastructure to support eHealth programmes, either on a national scale with provision of internet or phone access, or an institutional level with inadequate IT capabilities or skilled professionals.

Strategic vision: a lack of harmonized healthcare policy and governance models to support eHealth initiatives can make their adoption haphazard and unsustainable. The latest Global Observatory for eHealth survey by WHO (published in 2016) has shown that 73 countries already have an eHealth strategy in place, but these will take several years to become fully operational.

Design: tools which are not designed with the input of users, and thus are unable to fit into workflows or lifestyles, may struggle to sustain engagement and have optimal impact.

Education: Training the health care community in understanding and using eHealth tools can be challenging, and hard to deliver consistently, especially in over-stretched health systems. Populations may also require increased digital literacy to be able to take advantage of eHealth solutions.

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Evidence of effectiveness: Inability to consistently measure clinical and cost effectiveness can prevent adoption of and continuing engagement with eHealth interventions. There is also a question of how to scale the research that we have, as while there are many pilot studies but we are lacking evidence to scale eHealth interventions and tools, or to translate them into other settings or cultures. Additionally, applying a health systems lens to the evaluation of eHealth technologies requires identification of different indicators of impact.

Culture: often a culture change is needed towards embracing new technologies, and not viewing their adoption as a burden or a challenge to usual practice. Populations may also be wary of the involvement of technology in their health care, and trust will need to be built between patient and technology in a manner similar to the doctor patient relationship.

Privacy and Security: concern around keeping users data secure can prevent willingness to engage with eHealth, especially given the sensitivity of some aspects of health data.

Financing: the cost of hardware, software or appropriate tech support may be prohibitive or unsustainable.
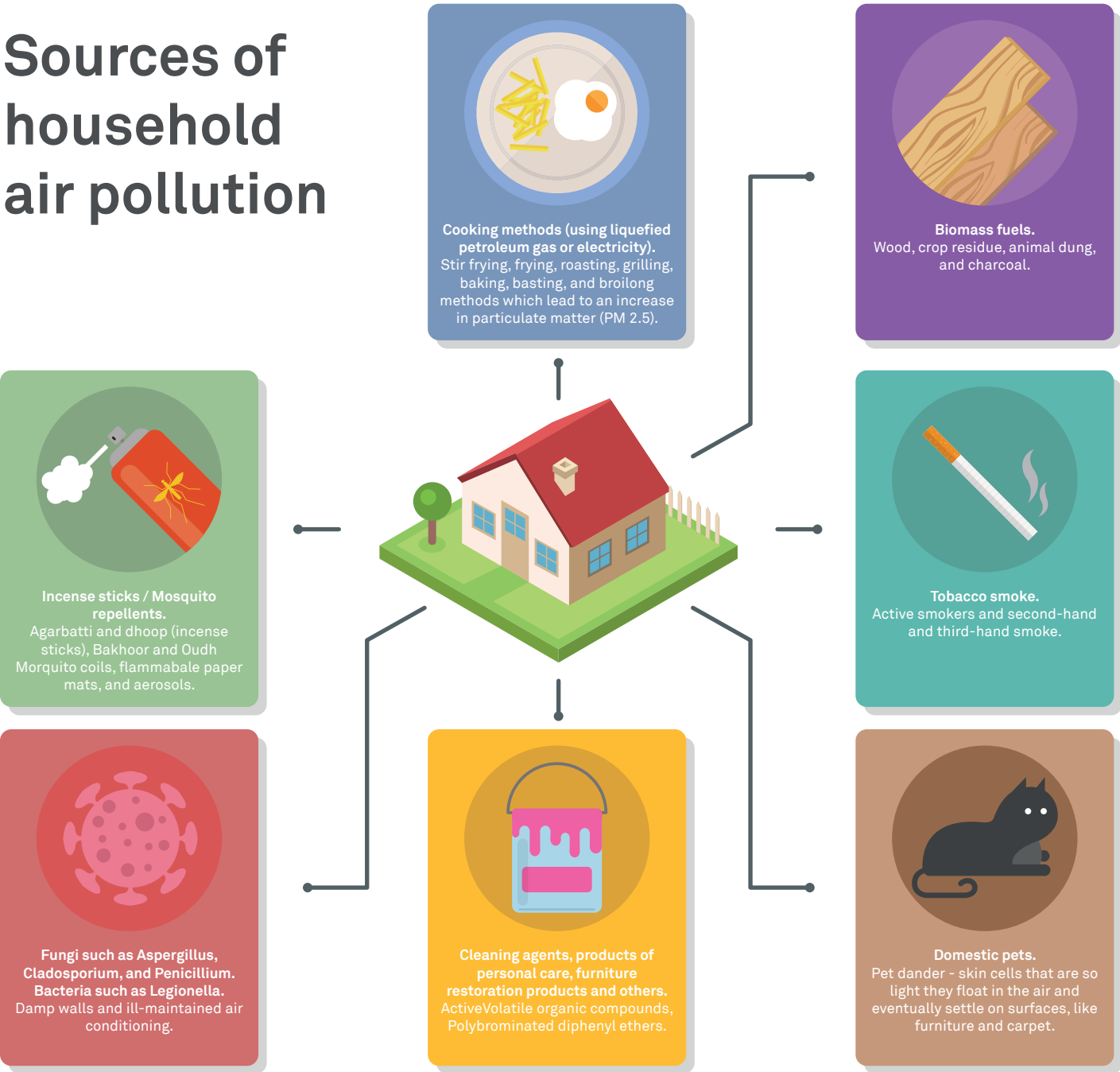
Conflicting priorities: there are many demands on health services, and some countries may view other needs as more pressing for their community or lack immediate capacity for the long term benefit.

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Air quality and non-Communicable Diseases

Air pollution

Air pollution is defined as the presence of substances in the air that are harmful to humans, animals, vegetation, or materials.[16] These substances can either be particulate matter or of gaseous origin. Two types of air pollution can be separated by their origin: household air pollution and ambient air pollution. Household air pollution (HAP) is generated indoors and present when staying in closed quarters. It is linked to poverty and mostly present in low and middle income countries.[17] HAP can be generated through a variety of sources, although cooking using solid fuels plays a major role. Over a third of the world population relies on solid fuels for cooking. While this number is declining overall, especially in low-income countries in eastern, central and western sub-Saharan Africa reliance on solid fuels for cooking remains high.[18] Other sources of HAP are tobacco smoke, construction material used in building houses, and heating and lighting.[19] A more extensive list of sources of HAP can be found in Table 2.

Table 2. (16) - Sources of household air pollution

Sources of household air pollution

Cooking methods (using liquefied petroleum gas or electricity).
Stir frying, frying, roasting, grilling, baking, basting, and broilong methods which lead to an increase in particulate matter (PM 2.5).

Biomass fuels.
Wood, crop residue, animal dung, and charcoal.

Incense sticks / Mosquito repellents.
Agarbatti and dhoop (incense sticks), Bakhoor and Oudh Morquito coils, flammabale paper mats, and aerosols.

Tobacco smoke.
Active smokers and second-hand and third-hand smoke.

Fungi such as Aspergillus, Cladosporium, and Penicillium. Bacteria such as Legionella.
Damp walls and ill-maintained air conditioning.

Cleaning agents, products of personal care, furniture restoration products and others.
ActiveVolatile organic compounds, Polybrominated diphenyl ethers.

Domestic pets.
Pet dander - skin cells that are so light they float in the air and eventually settle on surfaces, like furniture and carpet.

Ambient air pollution in contrast is the presence of pollution in the air outdoors. Major man-made sources of ambient air pollution are motorized road traffic, power generation, industrial sources, and residential heating.[20] Ambient air pollution can also be the result of natural sources like wind-blown soil or dust, volcanos or seismic activities, and wildfires.[21] A more extensive graphic displaying sources of ambient air pollution can be found in Figure 2. Due to the man-made sources, ambient air pollution is linked to industrial development.

With the industrial development of low and middle income countries, ambient air pollution is on the rise. In the past 25 years, there has been an 20% increase in deaths caused by ambient air pollution, with India and Bangladesh seeing the largest increase in pollution-related deaths out of the world's 10 most populous countries.[17] While household and ambient air pollution can be separated by the origin of the harmful particles, they have to be considered together.

There is a strong interplay between them, with HAP being a major cause of ambient air pollution in developing countries.[17]

Figure 2. Ambient sources of Air Pollution

Because they influence each other to such a great extent, differentiating harmful pollution originating from either HAP or ambient air pollution is difficult. Even though the discussion is still ongoing, it is the current believe that the origin of particulate matter in the air plays only a minor role in the development of diseases. Particles are considered to be equitoxic. This means that the toxicity of particles in air rises with a higher concentration, disregarding its composition.[18] However, this assumption is only correct for particulate matter. Gaseous pollutants act differently depending on their composition and origin. First off, they can be divided into two categories. Primary pollutants are released directly into the atmosphere, while secondary pollutants only form in the atmosphere, mostly due to primary pollutants.[22]

Examples for primary pollutants are sulfur oxides, nitrogen oxides, reactive hydrocarbons,and carbon monoxide. Hydrocarbons and nitrogen oxides can form ozone in the atmosphere and sulfuric acid is produced by atmospheric sulfur; both are examples of secondary pollutants.[22] A description of each of the common air pollutants and their sources is given in Table 3.

Table 3. Common air pollutants

Pollutant	What is it?	Common Sources
Carbon Monoxide (CO)	A gas produced in the incomplete combustion of carbon-containing fuels. It can impact health in high quantities, and also reacts with other pollutants in the air to form potentially harmful ground level ozone.	Natural sources of carbon monoxide include volcanoes and bushfires. Main sources of man made carbon monoxide are otor vehicle exhausts and industrial activities. Additionally, tobacco smoke is the main source of indoor carbon monoxide.
Sulphur Dioxide (SO2)	A gas which reacts easily with other substances to form harmful compounds such as sulfuric acid, sulfurous acid and sulfate particles.	The main source of sulfur dixide in the air is industrial activity that processes materials that contain sulfur, eg. the generation of electricity from coal, oil or gas tha contain sulfur. Sulphur dioxide is also released during processing of mineral ores and industrial activities that burn sulphur containing fossil fuels. Sulphur dioxide is also present in motor vehicle emissions, as the result of fuel combustion.
Nitrogen Dioxide (NO2)	A gas which contributes to the formation and modification of other air pollutants, such as ozone and particulate matter, and to acid rain.	Major source is the burning of fossil fuels: coal, oil and gas. Most of the nitrogen dioxide in cities comes from motor vehicle exhaust. Other sources of nitrogen dioxide are petrol and metal refining, electricity generation from coal-fired power stations, other manufacturing industries and food processing.
Particule Matter (PM)	A mixture of solid particles and liquid droplets found in the air. Particles are classified according to their size and chemical composition, with toxicity dependent on these.	Natural sources include bushfires, dust storms, pollens and sea spray. Those related to human activity include motor vehicle emission, industrial processes, unpaved roads and woodheaters.
Ozone (O3)	Ozone occurs naturally in the Earth's upper atmosphere, however at ground level it is formed when NO2 combines with other volatile compounds and is a harmful air pollutant.	The chemicals that react to form ozone come from sources such as motor vehicle exhausts, oil refining, printing, petrochemicals, lawn mowing, aviation and controlled burning.

Different gaseous pollutants damage the body in different ways, mostly depending on their chemical characteristics. Highly soluble gases such as sulfur dioxide damages the upper airways. In contrast, nitrogen dioxide and ozone are less soluble and can thus penetrate more deeply into the lung.[22] Carbon monoxide is even more soluble and enters the bloodstream without causing direct harm to the lungs. However, once in the bloodstream, carbon monoxide has a higher affinity to haemoglobin than oxygen, preventing the red blood cells of the body from transporting oxygen. This is acutely toxic, with a report showing a 1.2% increase in total deaths throughout Europe as a result of a 2-day increase of mean CO levels by 1 mg/m^3.[23]
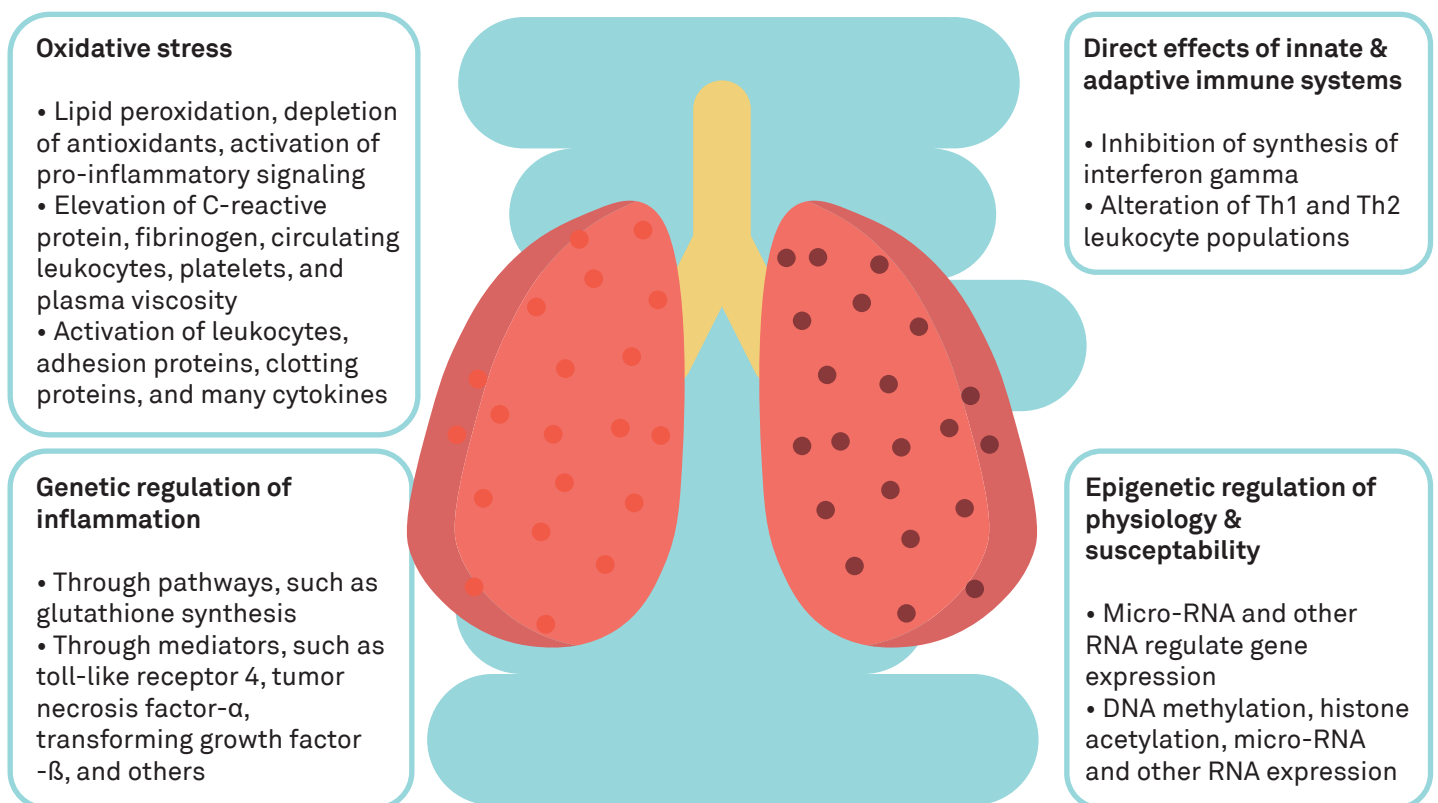
Particulate matter (PM) damages the body in different ways and is also classified differently. It is defined as the mixture of solid particles and liquid droplets found in the air.[24]

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PM is classified by the diameter of the particles. PM_{10} denotes particles < 10 mm in diameter; $PM_{2.5}$ particles are < 2.5 mm in diameter; and $PM_{0.1}$ particles are < 0.1 mm in diameter.[21] It is important to note that smaller particles are always included in the classification of the larger particles, which is why $PM_{2.5}$ makes up approximately 50% of the total mass of PM_{10}.[20]

Particles larger than PM 2.5 , also referred to as coarse particles, can be identified with the naked eye as dust or haze. PM damages the lung in a similar way as smoking does.

Particles taken in during breathing are filtered by the lung and accumulate, leading to chronic inflammation and scarring. This directly predisposes the lung to the development of lung cancer.[25] As coarse particles are too big to travel deep into the lung, they only affect upper airways and mucous membranes, causing coughing and irritations. The smallest particles, $PM_{0.1}$ can penetrate the alveoli and enter the bloodstream. $PM_{0.1}$ can be carried to various organs throughout the body and cause organ specific inflammation. Figure 3 provides a direct overview of the specific ways in which air pollution is able to damage tissue.
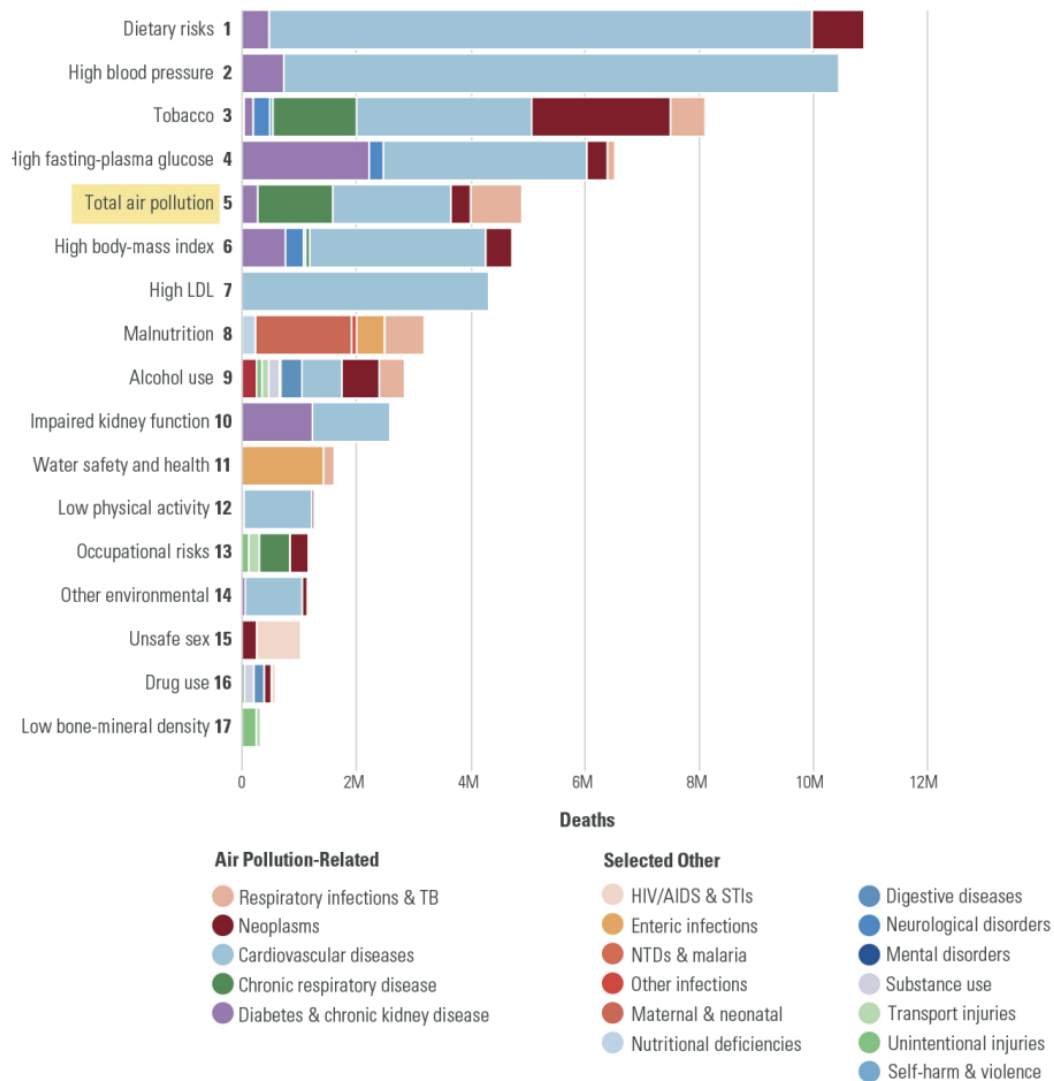
Figure 3. (21). Specific ways in which air pollution damages tissue.

Oxidative stress

• Lipid peroxidation, depletion of antioxidants, activation of pro-inflammatory signaling
• Elevation of C-reactive protein, fibrinogen, circulating leukocytes, platelets, and plasma viscosity
• Activation of leukocytes, adhesion proteins, clotting proteins, and many cytokines

Direct effects of innate & adaptive immune systems

• Inhibition of synthesis of interferon gamma
• Alteration of Th1 and Th2 leukocyte populations

Genetic regulation of inflammation

• Through pathways, such as glutathione synthesis
• Through mediators, such as toll-like receptor 4, tumor necrosis factor-α, transforming growth factor -ß, and others

Epigenetic regulation of physiology & susceptability

• Micro-RNA and other RNA regulate gene expression
• DNA methylation, histone acetylation, micro-RNA and other RNA expression

Air pollution and the burden of disease

Air pollution is considered to be the single most important environmental contributor to theglobal burden of disease (Figure 4), and is responsible to the annual loss of 8 million lives worldwide. It is estimated that 91% of the world population lives in areas where air quality exceeds WHO guideline limits.[26] Without aggressive intervention, the number of deaths due to air pollution is set to increase by 50% by 2050.[27] The majority of the disease burden of air pollution can be attributed to non-communicable diseases, primarily causing cardiovascular disease, chronic obstructive pulmonary disease (COPD) and lung cancer.[28]

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Figure 4 (29): Global ranking of risk factors by total number of deaths from all causes for all ages and both sexes in 2017.

Air Pollution-Related
- 🔴 Respiratory infections & TB
- 🔴 Neoplasms
- 🔵 Cardiovascular diseases
- 🟢 Chronic respiratory disease
- 🟣 Diabetes & chronic kidney disease

Selected Other
- 🟠 HIV/AIDS & STIs
- 🟠 Enteric infections
- 🔴 NTDs & malaria
- 🔴 Other infections
- 🔴 Maternal & neonatal
- 🔵 Nutritional deficiencies

- 🔵 Digestive diseases
- 🔵 Neurological disorders
- 🔵 Mental disorders
- ⚪ Substance use
- 🟢 Transport injuries
- 🟢 Unintentional injuries
- 🔵 Self-harm & violence

Numerous studies have analysed the impact of air pollution on health, finding a variety of short and long term impacts throughout the life course. Children have been shown to be particularly vulnerable to poor air quality. There is evidence that exposure to air pollution during pregnancy can impact fetal development, with associations made between air pollution and low birth weight, brain development and worse postnatal health outcomes.[30]

Globally, 543 000 children under 5 years die every year from respiratory disease linked to air pollution, while up to 14% of children aged 5-18 years have asthma relating to factors including air pollution.[31] It has also been implicated in the incidence of several childhood cancers.

For adults, there is robust evidence that air pollution is closely associated with cardiovascular and respiratory disease. Worldwide, almost a third of the cardiovascular disease burden is attributable to indoor and outdoor air pollution (17% and 13% respectively), as well as 29% COPD deaths being attributable to indoor air pollution and a further 8% to outdoor air pollution.[32] In the acute setting, several urban centres have also seen a spike in incidence and severity of exacerbations of asthma and other respiratory conditions, correlating to spikes in atmospheric pollutant levels.

Beyond physical health impacts, there is emerging evidence that air pollution is implicated in poorer mental health outcomes - for both adults and children.

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Studies have shown an association between higher concentrations of air pollutants and psychiatric medication usage, presentations of psychosis and symptoms of anxiety.[33] Recent longitudinal research has found that exposure to pollutants, such as nitrogen oxide and particulate matter, at age 12 increases the chance of experiencing depression at age 18.[34]

In the elderly population, who are already more vulnerable to the effects of air pollution, there has been a small amount of evidence that air pollution exposure contributes to a person's risk of developing dementia.[33]

Figure 5 (29): Proportion of NCDs attributed to air pollution

Disease Burden attributable to air pollution (2017)

Others - 18.0%

Chronic NCD - 82.0%
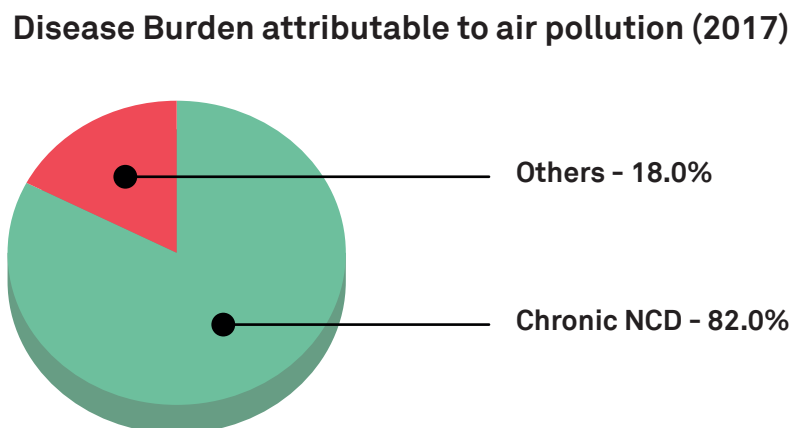
Air pollutants can have a wide ranging effect on the human body, and thus on health. When the lung comes into contact with such a pollutant an inflammatory response is initiated. This response is not locally limited, but spreads through the whole body. It can be measured through increased concentration of blood components that are typically seen in response to infections - including elevated C-reactive protein, fibrinogen, circulating blood leukocytes and platelets, and plasma viscosity.[35] Systemic inflammation damages the body in many ways, and is directly related to decreased vascular function.[36] This in turn can lead to many diseases of the vascular system, in particular arteriosclerosis.

It is important to note that air pollution is intimately linked to climate change, which causes further health problems.[37] Fossil fuel combustion, which is a major cause of ambient pollution, is also the most influential source of climate pollutants.[38] Climate change impacts health in numerous ways. Rising temperatures due to climate change have a direct impact on health, with heat waves killing over 125 million people globally between 2000 and 2016.[39]

As the climate changes, droughts become more numerous. These droughts lead to famines, which harm people through undernutrition.[39] Severe weather events such as flooding are rising in frequency due to climate change. Over 90% of natural disasters affecting Pakistan in the past 40 years have been triggered by climate change. In 2010, 15 million people, of which 6 million needed direct medical attention, where affected by floods in Pakistan.[39]

These are just few examples of the indirect harm air pollution can cause through climate change. This is why it is important to consider air pollution not as an isolated event, but as one that affects health in many, often understudied, ways. Figure 6 displays diseases in which strong evidence supports a link between their prevalence and decreased air quality.

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Figure 6. (27). Effect of air pollution on different organs

Brain: Stroke, Dementia, Parkinson's Disease

Eye: Conjunctivitis, Dry Eye Disease, Blepharitis, Cataracts

Heart: Ischemic Heart Disease, Hypertension, Congestive Heart Failure, Arrhythmias

Lung: Chronic Obstructive Pulmonary Disease Asthma, Lung Cancer, Chronic Laryngitis, Acute and Chronic Bronchitis

Liver: Hepatic Steatosis, Hepatocellular carcinoma

Blood: Leukimia, Intrvascular Coagulation, Anemia, Sickle Cell Pain Crises

Fat: Metabolic Syndrome, Obesity

Pancreas: Type I and II Diabetes

Gastrointestinal: Gastric Cancer, Colorectal Cancer, Inflammatory Bowel Disease, Crohn's Disease, Appendicitis

Urogenital: Bladder Cancer, Kidney Cancer, Prostate Hyperplasia

Joints: Rheumatic Diseases

Bones: Osteoporosis, Fractures

Nose: Allergic Rhinitis

Skin: Atopic Skin Disease, Skin Aging, Urticaria, Derographism, Seborrhea, Acne

Air pollution on a global scale

The WHO Global Urban Ambient Air Quality Database, which compiles data from over 4,300 cities in 108 countries worldwide, have shown that 'pollution inequality' between high income and low income nations is widening. Whilst around 60% of North American and European cities showed PM concentrations decrease between 2010 to 2016, 70% of cities in South and South-East Asia saw levels increase over this period.[40] About 90 per cent of premature deaths from outdoor air pollution in 2016 occurred in low- and middle-income countries and 50 per cent of these are in India and China alone.[41]

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As more developing countries accelerate their urbanisation and industrialisation processes, the problem of air pollution will become truly global. However huge gaps in the data remain, with almost all of Africa and most of the Middle East lacking real-time air quality monitoring.[42]

Globally, more than 93% of the children live in environments which have air pollution levels above the prescribed levels advised by the WHO[43] - with a disproportionate effect seen on those from lower socioeconomic backgrounds. The impact of air pollution on children in each WHO region per income level is shown in Figure 7.

Figure 7(43): Death rate per 100 000 children attributable to the joint effects of household and ambient air pollution in 2016

WHO region	Income level	Children < 5 years	Children 5–14 years
African	LMIC	184.1	12.9
	HIC	4.3	1.4
Americas	LMIC	14.2	0.7
	HIC	0.3	0.0
South-East Asia	LMIC	75.0	2.5
European	LMIC	8.8	0.6
	HIC	0.3	0.0
Eastern Mediterranean	LMIC	98.6	3.6
	HIC	5.3	0.4
Western Pacific	LMIC	20.5	1.0
	HIC	0.3	0.0
All	LMIC	88.7	4.5
	HIC	0.6	0.1
World		80.5	4.1

LMIC, low- and middle-income country; HIC, high-income country.

Improving air quality

While air pollution poses a global danger to human health, air quality can be returned to healthy levels through effective leadership, adequate strategies, and well-allocated resources. Many interventions to reduce air pollutions have been tested and proven as effective, showing that there are effective ways to combat the decrease of air quality. Having been developed in high-income countries, these interventions are now being increasingly used in middle-income countries.[17] Methods that have already been shown to be effective can be adapted by other cities or countries for their context, thus saving time and money. These methods can fight pollution on different levels, varying in effectiveness. It is important to realize that as started earlier, air pollution from different sources like HAP or ambient air pollution are interconnected and have to be tackled together.[21]

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Successful strategies to combat air pollution commonly involve a wide share of stakeholders, comprised of different agencies within and outside governments, on both a national and international level. All stakeholders must be fully integrated into the regional or national agenda of improving air quality. Involved government agencies should not be limited to health and environment, but also include ministries of finance, energy, industry, agriculture, and transport. However, it is not only the role of organizations to combat air pollution. Citizens play a major role in reducing air pollution through behavioural change.[21] Be it reducing actions that pollute the air or avoiding polluted areas, air quality must be combated in a holistic approach.[17] Interventions should mix primary prevention with downstream reduction of air pollution through filters and stack scrubbers.[17] This mix is important to achieve results quickly, because when implementing new interventions, having early success in reducing negative health effects of pollution is extremely important. Immediate positive results sway public opinion and lead to long term support of anti-pollution programmes. Still, fighting air pollution at its source has been proven to be much more successful than filtering the pollutants already in the air. While still being important to achieve immediate results, avoiding polluted areas is the least impactful approach of lowering negative health effects caused by air pollution (Figure 8).

Figure 8. (21): Importance of different interventions to tackle air pollution.
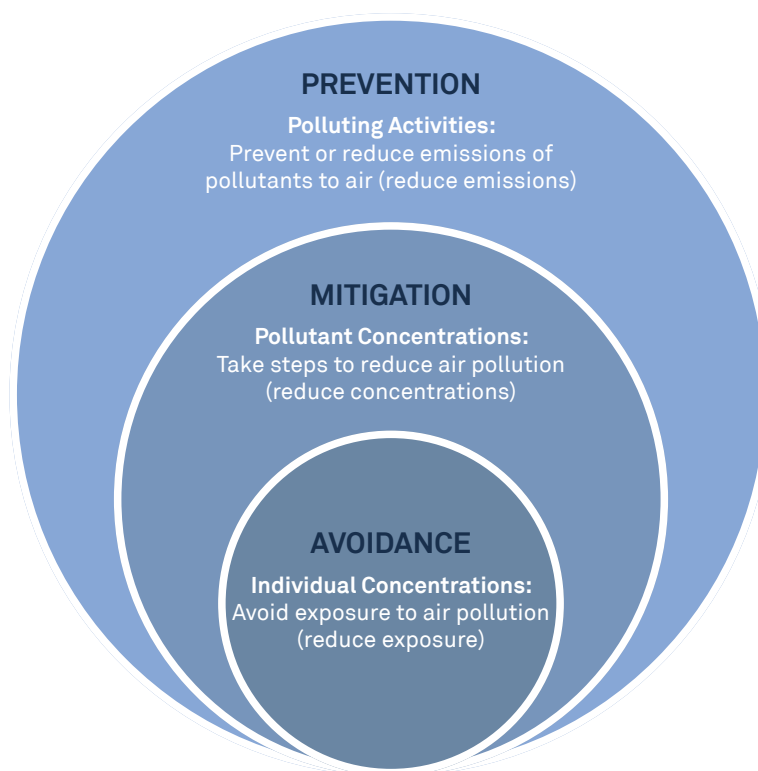
A first step in combating air pollution is installing adequate sensors. It is important to identify which areas are affected the most to know where to strike first. Quality metrics also help monitoring the progress of intervention campaigns. This helps communicating success in improving air quality, as well as adjusting less successful campaigns.[17] Early implementation of air quality sensors should be the priority for all successful interventions fighting air pollution. Central data coordination systems are of similar importance.A data driven approach that is standardized on a national or international level provides valuable resources for regulators, researchers, and policy makers.

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Monitoring air pollution is usually achieved by ground level sensors combined with atmospheric dispersion modelling.[44] Through this system, concentration and future dispersion of particles in the air can be calculated. This of high importance, as levels of pollutants vary depending and seasonal variations and day to day weather changes.[21]

HAP interventions mainly consist of reducing emissions by dirty fuels like coal, wood, or biomass that most stoves in low and middle income countries run on. This can be achieved by either replacing the stove with a cheap but more efficient rocket stove or changing the fuel they run on. Cleaner fuels are for example liquid petroleum gas (LPG), ethanol, or electricity. Most studies on reducing HAP through these means show a reduction of $PM_{2.5}$ kitchen concentrations of 40% to 80%.[18] However, even with these reduction the $PM_{2.5}$ measured in kitchens usually remains above the WHO Interim Target-1 for air quality of 35 µg/m ^{3}.[45] Furthermore, reviews show that very few studies on reducing HAP show positive health effects for the population studied, concluding that stand-alone interventions on HAP yield little to no health benefits.[46] Three factors have been described as to why studies have not been able to show a large impact of HAP inventions. One factor is that the adoption and use of HAP interventions was too low.[47] Households either did not implement clean fuels in the first place or did not continue using them. Another factor hindering the success of HAP is so-called stove stacking.[48] This means that household use additional clean fuels stoves while still relying on other stoves using dirty fuels. The third factor explaining the poor results of the studies holds community-level exposure at fault.[49] Pollutants from neighboring households or ambient air pollution find their way into the households using HAP interventions and raise the exposure to pollutants. These three factors are hindering the positive effect cookstove intervention could have, which is why it is important to consider each one of them when designing successful HAP interventions. This does not mean that using clean fuels for cooking does not have positive health impacts, but rather that they are difficult to detect due to an interplay of various factors.

Interventions targeting ambient air pollution are often carried out by governments and focus on laws that limit the expulsion of certain pollutants. These are often highly effective, as demonstrated by the US Clean Air Act from 1963. It has decreased the concentration of the six most common air pollutants by 75% since 1970.[50] It is important to note that this is a highly economic law, because every US dollar invested into controlling ambient air pollution has yielded 30$ in benefits.[51] Strategies to reduce ambient air pollution are diverse and tackle the issue from many angles. Examples include: low-emission vehicle standards, financial incentives for replacement and retrofitting of high-polluting vehicles, cleaner diesel fuels in marine vessels and railroad locomotives, and legally mandated reductions in emissions of oxides of nitrogen and sulphur.[17] An important principle to consider is the polluter-pays principle.

This means that polluters are legally required to pay for their pollution and its clean-up. The results of it is the creation of economic incentives to reduce emissions through more efficient production technologies, while also creating revenue to support the costs of pollution control programmes.[17] Going hand in hand with the polluter-pays principle, governments should end subsidies that support polluting industries such as gas, coal, and oil.[17] These subsidies in turn can be directed to non-polluting industries, guaranteeing economic growth that does not rely on polluting the air. A guide on how to tackle different sources of air pollution can be found in Table 4.

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Table 4. (17). Interventions to tackle different types of air pollution.

	Ambient air (outdoor) pollution	**Household air pollution**
Short-term interventions	Identify sources of key polluants to enable targeted interventions; target control of stationary sources and install dust management systems; establish monitoring systems; mandate improved fuel quality and engine standards; and design and implement effective enforcement systems.	Review current interventions - eg, cleaner fuels and cookstoves - and a determine the most scalable strategies; targeted education campaigns; expand support for successful current systems.
Medium-term interventions	Establish requirements for cleaner vehicles, including testing stations (controls on diesel vehicles, catalytic converters, converting to gas); provide incentives for use of electric and hybrid vehicles; upgrade public transport fleets.	Expand access to clean fuels and cleaner cookstoves; upgrade heating and other solid fuel systems.
Long-term interventions	Expand or upgrade public transit; faciltate active commuting by constructing walkways and cycle paths; create mechanisms to discourage vehicle use.	Full (possibly universal) access to clean fuels.
Policy and institutions	Undertake source apportionment to identify the most important sources os pollution; establish and prioritise control targets and timetables; establish a high-level intersectoral Steering Committee; involve the public and civil society organisations.	Define the target population; identify the responsible government agency with a madate for health improvement; formulate a practical strategy for upgrading or switching fuels; define financial incentives.
Building capacity	Achieve adequate monitoring and testing of major air pollutants and emission sources; develop understanding of source contributions; use vehicle testing stations.	Establish monitoring mechanisms; identify, review, and support local distributors and providers.
Common gaps and structural issues	Expansion to less well resourced secondary cities	Reduction or eleimination of use of solid fuels for heating

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The intersection of eHealth, air quality and NCDs

The intersection of health and technology has been recognised in numerous international agreements and statutes, with institutions such as the WHO passing resolutions highlighting their intention to capitalise on it's benefits. The United Nations (UN) and its member states have also highlighted the need to harness digital power and capabilities for the achievement of the Sustainable Development Goals (SDGs) - a set of globally agreed aims 'to end poverty, protect the planet and ensure that all people enjoy peace and prosperity'. Not only does the SDG agenda include a goal that directly pertains to technology (Goal 9 on 'Industry, Innovation and Infrastructure'), but the success of much this ambitious programme has been related to the use of digital innovation. For example, SDG 7 (on 'Affordable and Clean Energy') can be achieved through using digital technology to integrate renewable energy sources and digitise manufacturing processes. SDG 11 (on 'Sustainable Cities and Communities') calls for the exploration of the potential of smart cities, which would combine digital connectivity, data, and citizen knowledge to generates opportunities for public services to become better adapted to the needs of populations.

Yet technological innovation has not been applied or accessed equally throughout the world, and if current trends continue only the richest in society will benefit from its potential. As UN Secretary-General Antonio Guterres said at the closing of the 2018 High-level Political Forum on Sustainable Development: 'Technology has great potential to help deliver the SDGs, but it can also be at the root of exclusion and inequality. We need to harness the benefits of advanced technologies for all.' [52]

Healthy smart cities

1.1 What is a smart city, and where does the concept come from?
As with eHealth, there is no single agreed definition for the term 'smart city', risking confusion among policymakers about how to actually create a smart city. What commentators broadly agree on is that smart cities share at least one trait: they try to leverage the power of ICT in ways that improve residents' lives. Importantly, a city does not simply become smart simply by having high-tech cut and pasted onto it. The true measure of a smart city's success is not how much technology it uses or the "big data" it generates, but what kind of a positive impact it has on its citizens' safety, health and convenience.

1.2 Smart and Healthy Cities
The WHO Healthy Cities programme is an international initiative that aims to place health high on cities sustainable development agendas, and to promote comprehensive local decision making strategies for health protection. Basic features include community participation and empowerment, intersectoral partnerships and participant equity.[53]

As part of this global programme, about 90 cities are members of the WHO European Healthy Cities Network, and 30 national Healthy Cities networks across the WHO European Region have more than 1400 cities and towns as members. The primary goal of the WHO European Healthy Cities Network is to put health high on the social, economic and political priorities of city governments. Health should be the business of all sectors, and local governments are in a unique leadership position,with power to protect and promote their citizens' health and well-being.[54]

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The EU Directive on ambient air quality (DR 2008/50/EC) ensures transparency from local authorities on communication to the public on air quality. This law requires member states to provide up-to-date information to the public and other organisations through the media (art. 26, Annex XVI), such as warning the public in cases of high pollution concentrations (art. 19, 24, Annex XVI). However, there is no limit set concerning particulate matter in the law. Setting monitoring points and sampling areas are also included in the directive.

City of London sets a good example by providing useful information through its website - where citizens have access to information linking health and air pollution exposure.
Information is given on the different types of pollutants in each area of the city, along with the health impacts of exposure to this air. The Cleaner Air Better Business (CABB) project has, with the support of the Mayor of London, developed an interactive map of London that allows citizens to put in any route and be shown a low pollution walking option. The Clean Air Route Finder can be used to choose the cleanest route to one's destination.[55]

The website "Atmosphere for Poznań" in Poland informs the residents regularly about the forecasted and real air quality in the city. It is available for both desktops and mobile devices.
The service includes information on PM10, Sahara dust and ozone throughout Europe.
The Riga airTEXT is a free service for the public providing air quality alerts by SMS text message, email and 3-day forecasts of air quality, pollen, UV and temperature in the area.
Residents of Helsinki can get informed on the air quality through an online map. The map includes a 12 hour forecast and is also displayed on public transportation.[56]

Zagreb, in cooperation with their Institute of Public Health, developed the 'Zagreb Ecological Map'. It is an innovative program of the City of Zagreb, which aims is to unify many existing environmental monitoring data, networking of all city offices and competent institutions and informing citizens. The Eco Map provides an overview of updated data on water consumption for human consumption, urban areas of the city, soil of city gardens, weather data, pollen allergen data and air quality data in real time (on line) from eight locations in the City of Zagreb.[57]

Barcelona and the 'Internet of Everything' Cisco calls its own ''version'' of IoT the 'Internet of Everything'. The 'Internet of Everything' acts as the backbone around which technological initiatives are being undertaken, rather than projects occurring in silos. A 500 Km long underground fibre network is being installed progressively as the city carries out routine maintenance to its roads and other underground services, significantly reducing installation costs. A city-wide network of sensors provides real-time valuable information on the flow of citizens, noise and other forms of environmental pollution, as well as traffic and weather conditions. This enables the local authorities to streamline city operations including better environmental management, reduce costs, and improve economic, social and environmental sustainability. Barcelona's highly energy-efficient streetlights are also connected to the city's underground fibre network. They have been fitted with multiple features including CCTV (closed-circuit television), air quality monitoring sensors and WiFi, and are capable of dynamically managing the level of lighting depending on surrounding conditions to save energy (e.g., dim lights when no motion or pedestrians are detected in the street).[58]

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Singapore was recently named as the healthiest city in the world, and has also been labelled one of the smartest. In a culture that has long placed a high degree of importance of younger generations caring for their elders, the installation of remote monitoring systems enables families to keep an eye on their relatives and alerts them instantly if an incident is detected at home. Meanwhile, non-emergency healthcare can now be provided by video conferencing for those unable to attend hospital appointments.

Similarly, the UK app Love Clean Streets enables residents to use the GPS and camera on their smartphones to report any pressing environmental issues to their local authority. What should also be borne in mind, however, when designing a Healthy City, is that interventions can have the effect of entrenching pre-existing social inequality and class divisions. For example, green spaces and efficient public transport systems may be introduced in already wealthy districts, leaving those on the periphery unable to share the benefits. A further challenge in designing a Healthy City using technology is the "digital divide". Despite the fact that internet access is stronger in urban environments than in rural ones, strong discrepancies between ethnic, income and age groups still persist across countries. Given that many healthcare systems now more than ever require individuals to take an active part in the management of their own health, this is problematic.

eHealth in the field

2.1 eHealth : an exciting opportunity for health management
From Internet, genomics, robotics to artificial intelligence and sensors, technologies provide us with the opportunity for emerging and enhancing health and life quality. The applications of emerging technologies with end goal the improvement of populations and communities health are called "Population Health Technologies "(PHTs). They encompass a model that emphasizes prevention and change on a population level rather than on an individual context. PHTs promote behavioral, environmental, system-oriented technologies which can provide immediate, real-time information on potential unhealthy patterns.[59]

The challenge lies on motivating the individual when information and research have been acquired on a community level. Thus, many eHealth professionals point to the direction of tailoring schemas; it is more likely to appeal a user by providing individualised information and messages.[60]

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2.2 Technology as means of reducing the NCD burden

The health problems we are facing due to poor air quality cannot be solved with a single eHealth tool. Sources of air pollution are too different from each other to combat them all in the same way. Similarly, the NCDs caused by air pollution differ on an individual level and require individual solution. What they have in common is that technology can be used to tackle the issues associated with them. Prevention of air pollution is a key piece in reducing the NCD burden. This has been successfully demonstrated by the mTobaccoCessation program in India. Focusing on mHealth, this program is part of the Be He@lthy Be Mobile approach. It supports its participants in quitting smoking by providing them with tailored advice and daily messages to motivate them to quit smoking. Through this program, air quality is being improved and the incidence of NCDs is being lowered.[61] Once air pollution has already led to an NCD, management of this disease is of crucial importance. For this disease management, eHealth can be a valuable tool. By providing COPD patients with an online platform to ask questions and consult a physician, these patients have been more active in managing their disease.[62] Active, long term management of all NCDs is essential for patient well being. Chronic diseases need continues attention, which eHealth tools can provide.
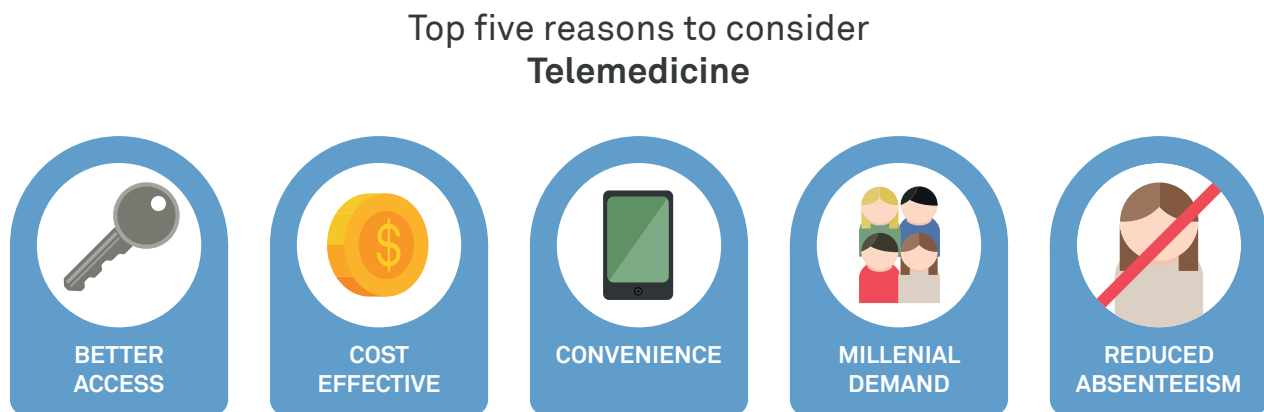
2.3 Sensors

New developments in miniature environmental sensors create the potential of directly linking individuals activities, environmental exposures and the health of COPD patients as they can carry a personal air quality monitor for long periods of time. COPD is the fourth leading cause of death worldwide and predictions indicate an increase of more than 30% in the following 10 years. Minimising the risk factors can have positive effects on the prevalence of the disease. Smoking is pointed as the most important risk factor for COPD; however, about 25-45% of the patients are non-smokers. Chronic asthma, other respiratory infections, exposure to environmental hazards such as dust and gases, air pollution and low socioeconomic status are some of the attributed causing factors. In an attempt to investigate and control some of the above mentioned factors, the COPE protocol has been created. Personal air monitors (PAMs) in a waterproof case are attached to the participants and employ ubiquitous sensing of a large number of geotemporal environmental parameters that can be measured simultaneously. The data collected provide a unique opportunity for a chance to alter patients behaviour; by providing evidence based data, policymakers may be able to target on efficiently reducing environmental risk and the public has access to information on how to minimise their own risks and improve their quality of life.[63]

2.4 Telemedicine

Telemedicine, the use of technology for monitoring or reviewing patients, has been cited as the arguably the most important technology for greenhouse gas reductions.[64] By implementing telemedicine we have the potential to reduce air pollution through reducing travel and thus the use of transportation; An example is the programme at UC Davis, California where telemedicine was applied in 13.000 outpatient consultations and as a result saved 4.7 million miles of travel and brought a reduction of 1,700 tonnes of CO2 emissions.[65]

Similar results have been reported in Scotland, Wales and Canada.[66] The broader rationale for using telemedicine is given in Figure 9.

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Figure 9. (67): Key reasons for the use of telemedicine

Top five reasons to consider
Telemedicine

| BETTER ACCESS | COST EFFECTIVE | CONVENIENCE | MILLENIAL DEMAND | REDUCED ABSENTEEISM |

The start-app world

It has been assumed that the development of an eHealth tool serves ultimately the population they govern.[68] It is important to develop tools and regulations that protect the entire population from poor air quality. As such, startups such as "Nasofilters" in New Dehli, India, have created small air filters that stick to the nostrils and protect from toxic pollutants, and these are affordable, unobtrusive and appropriately sized so they can be conveniently carried around in a handbag or in pockets and used as required.

Various applications exist already targeting allergen and specifically polen in the atmosphere. A review of five, free for the user, applications from Vienna, Berlin, Basil and London by Bastl et al. indicated a room of improvement concerning the accuracy of an existing quality forecast.[69]

AirRater is a mobile app that helps the citizens of Tasmania, Australia who are living with asthma, hay fever and other lung conditions to manage their symptoms and improve their quality of life. It uses a network of sensors that monitor smoke, temperature and pollen levels across the state. Users have the possibility to report the symptoms they experience in real time and place. The app then uses this data to build an air quality model. This allows users to understand the extent to which current symptoms are attributable to air quality in their location.[70]

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Summary

Globally, our air quality is getting worse - with a rise in dangerous pollutants resulting in 92% of the world's population breathing air deemed 'unacceptable' by the World Health Organisation. These pollutants are predominantly the result of transport emissions, industrial outputs and the polluting fuels or stoves used for cooking. We are already seeing these impacting health, causing inflammatory changes to body's vessels and organs which can lead to numerous diseases and chronic conditions.

The burden of non communicable diseases due to poor air quality is growing, with polluted air cited as the cause of 25% of fatal heart attacks and strokes,29% of lung cancer deaths and 43% of mortalities from chronic obstructive pulmonary disease.

The most vulnerable in society are disproportionately affected by poor air quality, with children and the elderly particularly susceptible to air pollution driven pathology - with concern that child development is being negatively impacted by poor air quality. There is also inequality seen between nations, with more than 90% of air pollution-related deaths occur in low- and middle-income countries, mainly in Asia and Africa.

There has been a huge increase in the availability and use of digital technologies in recent years, with the field of eHealth seeing rapid expansion. Technology is now being used for population health and disease prevention, as well as supporting community and clinical care of conditions. Yet eHealth policy and strategy has not kept pace with technology development, and so barriers have arisen surrounding its regulation and integration to health systems. Additionally, much of this health technology has been made in high income countries, and there has been little evaluation of whether these tools are clinically effective or safe to translate into other settings.

Technology can be used to support the monitoring and management of NCDs, as well as preventing their occurence. These range from symptom trackers to health information tools to environmental monitors. Although not directly classed as 'eHealth' technologies, those which can promote improvement in air quality and thus reduce pollution emissions, will have direct benefits on populations' health. Effective technology employs user centred design, to ensure that those availing of the technology are willing to engage with and able to use it - and so regardless of whether developing a tool for patients, professionals or industry, designers should include adequate user input and testing in their development process.

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eHealth

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Your guide to Berlin

Public Transport

With a valid ticket, ticket holders have access to the whole of Berlin's public transport network: the S-Bahn (suburban train), U-Bahn (underground/subway), buses and trams. The fare depends on the tariff zone and the ticket's period of validity. Berlin is divided into three tariff zones: AB, BC and ABC. Tariff zone AB includes the urban area to the city boundary. Zone ABC additionally includes Berlin's surrounding area and Potsdam main station.

If you plan on staying in the city of Berlin, you will only need a ticket covering the AB zone. However, if you are landing at the airport Berlin Schönefeld, you will need an ABC ticket for your journey from the airport to your accommodation.

When considering whether to buy a day ticket or a single trip ticket, you should know that it's worth buying a day ticket (Tageskarte) if you are going to take three or more journeys that day. Otherwise, it is cheaper to buy a single ticket (Einzelticket) for every trip. Bear in mind that a day ticket is only valid until 3 a.m. the following day, not 24 hours. The U-Bahn station closest to the CIEE Global Institute, where the Challenge is taking place, is Gneisenaustraße on the U7 line. It is inside Zone A.

We highly recommend that you download the BVG App before you arrive. It is the official app from Berlin's public transport company and includes everything from a network plan to a travel planner. You can buy tickets through it or look up fairs. Alternatively, a travel planner for Berlin's public transportation is included in Google and Apple Maps.

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Unlike in other big cities, the trains in Berlin are accessible without going through a turnstile.
You still have to buy a ticket (and keep it with you) though, because ticket inspectors randomly go through trains to check your tickets. This is why you have to buy a ticket at the platform and validate it. Once validated, your ticket is valid for a one-way trip no longer than 2 hours.

If you exceed this time, go back, or are caught without a valid ticket, you will be removed from the train and fined. The fine in Germany is 60€ per offence.
Even if you are still a student, you have to buy a regular ticket. A reduced fare is only available if you are under 15 years old!

Berlin subway map

Airports

There are two active airports in Berlin, Tegel Airport (TXL) and Schönefeld Airport (SXF). Both are equally close - about 30 minutes by public transport - to the CIEE. Tegel Airport is in the north of Berlin. If you plan on staying in accommodation in the northern part of Berlin, Tegel is probably better suited for you. What you have to keep in mind, however, is that there is no train station at Tegel, so you will have to take a city bus to your destination or the nearest train station. Schönefeld Airport is in the very south of Berlin. If you plan on staying in that area, this is the airport to fly to. Schönefeld has its own S-Bahn station, which is just a short walk away from the airport terminal. From both airports you will be able to reach the CIEE with only changing trains/buses once. Ultimately, the airport you fly to will depend on the best available route from where you are coming from.

Accommodation

Accommodation in Berlin is as diverse as the city itself. From Airbnb to 5-star hotels, you will find everything to suit your preferences and budget. As long as you are staying inside the AB zone and you are close to a train station, it will probably not take you longer than 30 minutes to reach the CIEE Global Institute.

However, we recommend that you check the transport connection between your accommodation and the CIEE before making your booking. As the event will take place near Gneisenaustraße U-Bahn station in the district of Kreuzberg, we would recommend looking for a hostel in Kreuzberg or in a neighbouring district, such as Neukölln, Tempelhof, Mitte or Schöneberg to avoid difficulties getting to and from the CIEE.

Here is a list of possible hostels you might like. A full selection can be found and booked on HostelWorld (www.hostelworld.com).

• Grand Hostel Berlin (grandhostel-berlin.de)
• Cat's Pajamas (thecatspajamashostel.de)
• Three Little Pigs (three-little-pigs.de)
• Transit Hotel (hotel-transit.de)
• Happy Bed Hostel (happybed.de)
• Comebackpackers (comebackpackers.com)
• Generator Hostel (Berlin Mitte and Prenzlauer Berg)
• Pfefferbett Hostel (https://pfefferbett.de/)
• East Seven Hostel (https://www.eastseven.de/en/welcome.php)
• Circus Hostel (https://www.circus-berlin.de/)
• Pax Pax Downtown Hostel (https://www.baxpax.de/en/welcome-to-baxpax-downtown/)

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If you prefer to stay in a hotel, this is a small selection that we can recommend and from where the location is easily reachable:

• Tryp Berlin Mitte
• ibis Berlin City Potsdamer Platz
• Hotel 38
• Hotel Adelante
• Mövenpick Hotel Berlin
• Hotel Motel One Berlin-Mitte
• Fjord Hotel Berlin

Since the location will be open for you 24 hours, it is also possible to stay there in order to work on your projects and take a rest. However, the CIEE is not intended as a place for you to sleep during the night.

What to do in Berlin

Food and Bars

Berlin's food is very diverse, with every imaginable cuisine on offer. The two kinds of street food that Berlin is most famous for are Currywurst (sausages in a sweet ketchup, sprinkled with curry powder and often served with French fries or "Pommes") and döner (a Turkish kebab made with meat cooked on a rotisserie and stuffed with salad). You can buy these on practically every street corner in Berlin, but the two most famous shops are actually within walking distance of each other. If you are prepared to stand in a queue, you should definitely visit Curry 36 and Mustafas Gemüse Kebap for some of Berlin finest street food.

Naturally, a city with a nightlife like Berlin's also has enough bars to suit everyone's taste.
However, you may also purchase alcohol from the supermarket and drink it in the park!
When buying any fizzy bottled drinks, you pay a small deposit (Pfand) in addition to the price of the drink. This is to encourage you to recycle it by returning the bottle to a machine in the supermarket (Pfandautomat) where you will receive the money back in the form of credit that can be used in the shop in your next purchase. If you don't want to return your bottles to the supermarket, it is acceptable in Berlin to place them carefully underneath one of the many orange bins and let someone else take them. Unfortunately, the deposit on these bottles is a lifeline for the many homeless people living on Berlin's streets.

If you have any special needs or preferences, such as vegetarian, lactose-free, gluten-free or vegan food, you will find appropriate food in every supermarket. The most common supermarkets are Rewe, Edeka, Kaufland, Penny, Netto, Lidl and Real. There are also a couple of organic supermarket chains, namely Denn's and Bio Company.

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Here are some of the eateries that Organising Committee members can recommend and which are less touristy than the places you typically find in the city centre. The addresses can be found on Google Maps and most are quite close to the CIEE.

• Chen Che and From Hanoi with Love for Vietnamese cuisine (Mitte and Neukölln, respectively)
• Schiller Burger and Illegal Burger (Neukölln)
• Sahara Imbiss for halloumi, falafel and magali (Kreuzkölln)
• Marjellchen for traditional German/Prussian cuisine (Charlottenburg)
• Trattoria Masaniello for authentic Italian pizza (Neukölln, close to the CIEE!)
• Erste Sahne and Mos Eisley for ice cream (Neukölln)
• Himali for Nepalese cuisine (Schöneberg)
• Nosh Deli - a mixture of Asian, European and African cuisine in Schöneberg
• Klunkerkranich for the ultimate Berlin-rooftop-bar-experience (accessible from inside the Neukölln Arkaden shopping centre - just take the lift to the top floor and follow the signs through the car park)
• Zola and Monela pizzerias for a napolitan gastronomic experience
• Musashi for sushi (very small but one of the most authentic tastes)
• Kokolo for ramen
• Kimchi princess for korean food
• Holy flat for healthy, creative power bowls

Sightseeing and Relaxation

Although you probably won't have much time during the Challenge, we highly recommend visiting some of Berlin's most famous sights afterwards. In its almost 800 years of history, Berlin has amassed a great number of historical and contemporary points of interest. One of the most famous landmarks of Berlin is the Fernsehturm (TV tower), which was built when the city was divided into East and West and is located on Alexanderplatz. This iconic structure is the tallest building in Germany and is visible from almost every location in Berlin.

Though pricey, going up there is definitely worth it. The big "silver ball" in the building houses a restaurant that revolves around its axis once every 30 minutes, so that while treating yourself to a traditional dish of Schnitzel and potato salad, you can enjoy a fantastic view of the city.

From the Fernsehturm it is only a short walk to the Aquadome, a giant aquarium in the lobby of the Radisson Blu hotel. The aquarium is so tall that an elevator rides right through it. Also nearby is the DDR Museum, which gives a great insight into everyday life under Communism in the German Democratic Republic (1949 - 1989). From there you can walk down the street Unter den Linden, where many prominent buildings such as the Humboldt University and the Staatsoper are situated. Incidentally, if you are interested in East German history, a must-see is the old Stasi prison (Gedenkstätte Berlin Hohenschönhausen) in northeast Berlin. For only a couple of Euros, you can get a fascinating guided tour of the prison and learn about how political prisoners were treated (and tortured) under the GDR regime.

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At the end of the street you will see the Brandenburg Gate (Brandenburger Tor). On the other side of it is the imposing Reichstag building where the German parliament (Bundestag) sits and the large Tiergarten park, leading up to the golden Victory Column (Siegessäule) located on Straße des 17. Juni. Make sure you don't miss seeing the Adlon hotel, one of the oldest and most iconic hotels in Germany.

On the left of the Brandenburg Gate is the Holocaust Memorial, easily recognisable by the many rectangular concrete slabs rising out of the ground. If you are interested in learning more about the Holocaust, you can visit the Memorial Museum, which is housed right there underneath the slabs.

Kreuzberg offers a few great pitstops for your tour - the Jewish Museum and the Berlinische Galerie for contemporary art - but you should definitely wander through its streets and breathe in the lively and multicultural atmosphere while you are there. Do be careful with your personal belongings, as pickpocketing is common, particularly in and around the U-Bahn station Kottbusser Tor.

As well as being the capital of Germany, Berlin is also the country's greenest city and offers an abundance of parks and lakes. Not too far from the CIEE, you can find the massive Tempelhofer Feld, the location of the now disused Tempelhof Airport. The Tempelhofer Feld offers space for cycling, kite flying and barbecuing, and often gets very busy on warm summer days.

If you bring your swimming costume, you can also head up north to the lake Plötzensee which offers a sandy beach and an Imbiss, where you can fill up on Currywurst and Pommes.

Good to Know

• As you might already know, in Germany the power sockets are of type F. The standard voltage is 230 V and the standard frequency is 50 Hz. Whether you need a power adaptor depends on the plugs used in your own country. Please remember to check this before your trip.

• Although your participation fee for the Challenge also provides you with a ticket to the public transport system, you can also make use of the bike rental systems across the city if you download the correct app onto your phone. Do be careful, however, especially when cycling straight ahead at a junction when a car is turning right. Every year, there are a number of cycling fatalities on Berlin's roads.

• Most of the stores in Berlin are closed on Sundays. There are a few exceptions. Small kiosks "Spätkauf", typically referred to as Späti, as well as supermarkets at S-Bahn Friedrichstraße, Südkreuz or at Berlin Hauptbahnhof (main station) tend to be open on Sundays, but they can get very crowded.

• Always make sure to have some cash with you (Euro). Credit and debit cards are not always accepted and when eating out, you are always on the safe side with paying by cash.

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• If you are a vegetarian or vegan you won't have any problems finding food you like in Berlin. Plus, the Marheineke Markthalle (a big market hall) which also offers a vegan grocery shop and café, can be found near the CIEE.

• Jaywalking in Berlin is not only frowned upon, but also illegal. Though the fine for crossing a street when the light is red is only 5-10€ (and seldom enforced), you might get called out by other people, especially senior citizens. When children are near, you should not jaywalk in order to avoid conflict with others.

• As already mentioned, theft is common - particularly in Kreuzberg but increasingly across the city and especially on public transport. Don't walk around with your wallet or mobile phone in the back pocket of your jeans, and keep a hold of your belongings at all times.

✔ If you find yourself in danger or need the police in an emergency, call the number 110.

Apps to make your life easier

• Drive Now, Car to Go and Coop are some of the cities many options to move around. Car and scooter sharing is broadly used and makes your sightseeing experience much better. Make sure you register before arriving as in many cases the verification of your ID can take up to some days.

• Foodora: Given that it's hard to walk out your front door without stumbling into a restaurant in some parts of Berlin, you need to be pretty lazy to resort to this bicycle delivery service. But we all have those days when the hangover has chained us to the sofa (and judging by the amount of Foodora cyclists peddling in Berlin, we're not just talking about Sundays).

• Berlin-Vegan: Though Berlin is pretty vegan friendly, it can still be tricky to pinpoint exactly where to enjoy a vegan meal. This app has links to over 170 restaurants, fast food outlets and ice cream parlours, more than 100 cafes that offer beverages with soy milk, 230 bakeries, and a further 100 supermarkets and pharmacies that stock vegan products.

• Street Art Archive : Some love it, others hate it. But street art and graffiti are part and parcel of Berlin. For those with an enthusiasm for the spray can, this app is an ideal tool. It provides a map of Berlin complete with recommended street art walking tours, walls where spraying is legal, and buildings with some of the most famous street art facades in the city. More still, it will direct you to spray shops, galleries that contain original street art, and cafes and restaurants that have embraced the city's grubby graffiti ethos.

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Meet the team

Abila Derrick Bary

Cytologist

I am a Cytologist (BSc.) with interest in prevention and early detection of Non-Communicable Diseases like Cancer. It's important to innovate for the challenges leading to the rising burden of NCDs. The use of cost-effective and secure technologies in healthcare in support of the health and health-related fields including healthcare, health surveillance and health education, knowledge and research is invaluable. The Young Leaders for Health Entrepreneurship Challenge provides a platform for interdisciplinary teams of students to develop ideas to tackle the burden of NCDs by applying eHealth.

Claudia Batz

Public Health

I was very fortunate to participate in the 2018 YLH Social Entrepreneurship Challenge in E-health. At the time, I was amidst my Master of Public Health at Imperial College London where I undertook modules on the Foundations of Public Health Practice, Global Health Challenges, Global Health Innovation and E-health.

The YLH experience confirmed that my decision to study an MPH after completing my BSC Biology was in-fact the best I could have ever made. I was able to experience public health in action and put into practice what I had just learnt. As team's, we developed eHealth tools that offer practical, innovative and sustainable solutions for public health problems. Moreover, my team was able to delve into the topic of mental health, one that is very close to my heart and high on public health agenda.

I want to give other students and young professionals the pleasure of experiencing the same life-changing few days.

Having lived in Hong Kong with family in the United Arab Emirates, United States of America and Turkey I have experienced the sheer inequity in access to healthcare that citizens face. I believe that only through partnerships; multi-sectoral and international collaboration can we make progress to solve the pressing health challenges the world faces today.

Meet the team

Martin Blohmer
MD Candidate

Even though I only recently started my medical studies, I am already aware that medicine cannot be approached from one single area of expertise. Instead, members of many disciplines have to work together in order to make health care the best it can be. To facilitate this teamwork, I joined the organising committee of the YLH Social Entrepreneurship Challenge on eHealth. eHealth is a rapidly evolving field that has the power to transform the lives of everyone involved in the health sector, from patients to doctors and engineers. This is why I will support all participants' projects in their quest to achieve this goal.

Shenuki De Silva
Healthcare

Access to healthcare should be a right to every citizen.Living in the US, I have seen people struggling to access proper healthcare as it is only affordable to a certain population class. By studying healthcare and healthcare systems, I believe I can acquire the necessary knowledge to help other countries and every citizen afford his medical needs. This internship is one of my first step into achieving my goal.

Ricardo Ferreira Flores Filho
M.A. Candidate in Standardization, Social Regulation and Sustainable Development / B.A. International Relations

Generating public goods through shaping policies is what has driven me throughout my academic path. Being Health determined by the social and economic environment, the physical environment and the person's individual characteristics and behaviors, I strongly believe in its importance for us all. Indeed, the economic, social and environmental responsibilities we have to the world deserve the most of our professional and personal attention.
I am really proud of taking part in the organising committee for the YLH Social Entrepreneurship Challenge on e-Health, as it gathers an interdisciplinary team and provides a great platform for young people and their ideas.

Meet the team

Reem Goda
Clinical Pharmacist

As a recently graduated clinical pharmacist, I have been volunteering in public health awareness projects and providing people with medical advice since my first day of college.

Last May, I was lucky enough to attend the World Health Assembly at Geneva. Ever since, I have been especially passionate about public health causes, specifically how we can help people get the health care they deserve, along with strengthening the health system and universal health coverage.

Young Leaders for Health is the place I was looking for, because the future of our health depends on us - young people and future health care providers. Through these challenging cases, we will learn, have fun, and overcome lots of obstacles.

Throughout the last 5 years, I've had the chance to learn about many health issues that are endangering our health and wellbeing. To overcome this, I believe one of the most pressing infrastructure solutions is to build smart cities which implement eHealth strategies.

Tanya Herfurth
Political Science

As a founding board member of Young Leaders for Health, I wanted to expand our non-profit's undertakings by starting the YLH Social Entrepreneurship Challenge. I believe that the biggest flaw in the current functioning of public and global health is the lack of interdisciplinary working. This is how the concept of this endeavour came about. However, without my excellent team, it simply would have remained a concept. Together, we have created the YLH Social Entrepreneurship Challenge on eHealth, which this year focuses on tackling non-communicable diseases and air quality.

We want to empower students and young professionals by giving them the platform and the means to launch a sustainable project in the realm of eHealth systems.

I am a former medical student currently studying political science, specialising on international political economy.

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Meet the team

Suprabath Kalahasti
Public Health, Data Sciences, Epidemiology, Health Economics

I am currently a Masters student in Public Health from the University of Gothenburg (Sweden). My research interests include health system strengthening & financing, data sciences and epidemiology.

I have been a part of international healthcare development projects which gave me a great exposure and enhanced my interest and broadened my skillset in the field of public health. I strongly believe that technology enhances the scope of healthcare service delivery with minimum resources at its disposal. This belief led me to be a part of the YLH Social Entrepreneurship Challenge on e-Health organizing committee. I am thoroughly looking forward to this experience of collaborating with a diverse set of people in this collective action to develop sustainable health solutions for the society.

Dara Karakolis
Nutrition

With a background in clinical nutrition and dietetics I have seen how the food we choose to eat is influenced by a multitude of interconnected determinants and this creates numerous opportunities for public health interventions. I have been exposed to a wide and varied curriculum which has educated me in many fields and specialisms of nutrition practice. With the growing shift away from typical healthcare practices, I believe moving with innovation and technology is the way of the future.

The importance of communicating health care to the public, in a clear, concise and culturally appropriate way has driven me to purse this challenge on eHealth. I would like to be a part of making change on a larger scale. I am truly passionate and ready to advocate and work for change to benefit the rights and dignity of the population.

Meet the team

Michele Matta
Doctoral Student, Nutrition, Public Health and International Health Communication

Healthcare should be available to all citizens. With a background in nutrition, a specialization in public health and a health communication, I am currently in the process of building a thesis to uncover associations between fatty acids and breast cancer risk, as well as mortality. In a nutshell, I am looking into improving nutrition guidelines by studying the effect of fats on us.

In the same scope, I believe that our generation has the means to improve healthcare with the right tools at hand. This is why empowering students and young professionals with the right tools, by providing opportunities to meet and network in an international & interdisciplinary environment enabling collaboration, is an asset to tackle Public Health challenges.

The aim is not world peace, but healthcare improvement even if it is by 0.001.

Lisa Murphy MD
Digital Health, Global Public Health and Health Leadership

I believe the Young Leader's for Health eHealth challenge provides an opportunity to catalyse collective intelligence and user centred design, drawing on the skills and experience of some of the world's leading youth health advocates. Having worked at the intersection of inequalities and NCDs for several years, I have become increasingly passionate about addressing these diseases at their roots and empowering communities to take ownership of their health. My experience in health technology has shown me the incredible potential for the development of cross cutting innovative solutions to some of our biggest health challenges, with the risk that technology will perpetuate inequalities rather than address them driving me to ensure the most ethical and equitable technology development. The complex nature of NCDs means they require us to break down our traditional silos of working and ensure the wider determinants of health are considered in everything from education

to urban planning - a goal I hope to support our participants in reaching.

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Meet the team

Chrysoula Nifora
Physiotherapy & International Health

As a student of Physical Therapy I was introduced to the broaden and fascinating world of Health sciences and later during my master in International Health I was intrigued by eHealth and the amazing impact and use of technology in the field. My work experience lies mainly on health prevention and my research focus is Women's Reproductive Health. My primary career goal is to promote accessibility and efficiency of health services.
I am excited to be part of the organizing committee of the YLH Social Entrepreneurship Challenge on eHealth and help promote innovating ideas and interdisciplinary collaborations.

Sheetal Patpatia
Translational Medicine

Studies in Translational Medicine has grown my interest in bio-innovations and personalized medicine, which can be used for betterment of public health by bringing multi-disciplinary approach. This has made me also realize the importance of better health care systems, global health and its challenges. I'm currently working as a researcher and focusing on antimicrobial resistance, which is an emerging global health issue. I believe that there are lot of innovative ideas all around us but they are needed to be brought together. I'm really thankful to be as part of YLH Organizing committee and by being part of it, I would like to share my knowledge, support participants to be more innovative and help them recognize their potential within the challenge.

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Meet the team

Natalia Tousiaki

Doctoral Student Neurodegeneration, Neuroscience, Molecular Biology

Natalia studied Molecular Biology in Greece and extended her education with postgraduate studies on Neuroscience in France and Germany. Currently, she is performing PhD studies in Switzerland in the field on neurodegeneration. In the past, she has been involved with NGOs in her country and has participated in several exchange programs focusing on social and political issues. Out of interest on the global health challenges we are facing, she aims at extending her studies to that direction. She joined the YLH to share her motivation with other young health enthusiasts around the world!

Hernâni Zão

Doctoral student digital media, oncology, communication sciences, biology

Hernâni Zão Oliveira holds two bachelor degrees in Biology and Communication Sciences and a master's degree in Oncology from Porto University. He is currently co-coordinating the first Portuguese Creative Laboratory for Health Literacy under his PhD in Digital Media, a program in partnership with the University of Texas, at Austin. At the beginning of 2018, Oliveira was selected to join the innovation fellows program promoted by the European consortium EIT Health. Hernâni is also the founder of BRIGHT DIGITAL, a start-up oriented to the development of technology to increase therapeutic adherence. His projects in the field of Breast cancer and Pediatric Oncology were awarded with the Diogo Vasconcelos Social Entrepreneurship Prize, the Santander Bank RedEmprendia Innovation Prize and the 2017 Astellas Oncology C3 Prize.

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YOUNG LEADERS FOR HEALTH

SOCIAL ENTREPRENEURSHIP CHALLENGE ON EHEALTH

NON COMMUNICABLE DISEASES & AIR QUALITY

JUNE 13-16, 2019
BERLIN, GERMANY